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(54) **A slide.**

(57) A slide structure for use with a sled 16 suitable for human occupancy is designed to have human occupant sleds sliding down into a body of water. The slide structure 15 comprises a support framework 18, on which a plastics sheet material is provided, and a water supply means which is adapted to supply only a thin film of water to the slide structure of an upper surface of the plastics sheet material. This water supply means may be operated at lower power levels and water supply rates, to provide the thin film and thus a very low coefficient of friction, so that the sleds attain a high speed for a quiet, fast, smooth and more exciting ride, yet with reduced wear on both the slide and sleds.

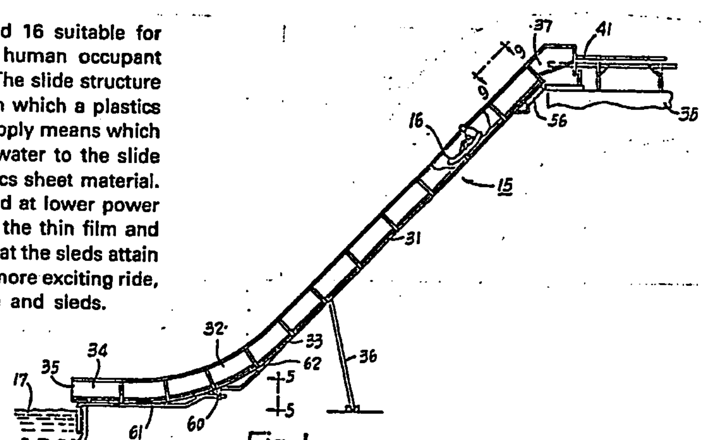

Fig. I

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Croydon Printing Company Ltd.

A Slide

This invention relates to slides and particularly to slides suitable for use with a sled for carrying a person, for example as an amusement ride.

A slide for sleds or small toboggans has previously been used and sold in the United States. This slide is typically positioned to direct a sled towards a pool of water so that the human occupant of a sled will accelerate down the slide and then skim across the surface of the body of water in the pool. The slide has a sled support surface that comprises a series of rollers set transversely of the path of the slide. More specifically, each roller comprises an aluminium tube journaled at each end on a fixed shaft in the slide support structure. The slide has a curved lower section and it has been found that the rollers tend to wear out from use, especially those rollers in the curved lower section which are subjected to high G forces and high acceleration forces from the successive sleds. This slide arrangement is also subject to bearing failures even though many different forms of bearings have been tried, including ball bearings with steel balls, roller bearings with steel rollers, plain bearings, nylon bearings, and oil-impregnated wooden plain bearings. The latter appear to be generally the most satisfactory: however, they are still subject to bearing failure and to wearing through of the 0.06 inch (1.5mm) wall thickness of the aluminium rollers, especially at the curved lower section of the slide. Also, such rollers are noisy in operation, which may be a liability in a quiet area. In addition, the rollers have spaces therebetween and thus, there is always the concern that a person might get his hand or foot caught between such rollers. A principal reason that the lower section rollers seem to wear much more quickly than the upper section roller is that the sled has already accelerated to a high speed by the time it reaches each of the lower section rollers in succession. Thus, such rollers have to be accelerated almost

instantaneously to the speed of the sled; otherwise, a sliding contact occurs between the roller surface and the sled rather than a rolling contact. Additionally, the heavier the bearing, the harder it is to accelerate the roller to the speed of the sled. This was found to limit the terminal velocity of the sled off the lower section of the slide, and hence to limit the distance which the sled can coast across the surface of the water.

Other water slides have been used in operation and are generally of two different types. The first type is one which curves laterally, is usually made from a fiberglass-reinforced resin plastics material, and may have a generally semicircular cross section. This type of slide is meant for body sliding without any protective mat or sled. The second type is one made from sprayed concrete, such as gunite, again which may be laterally curving and have a generally semicircular cross section. Since the surface of this concrete-lined slide is rather rough, a protective mat is used to protect a person sliding down into a pool of water. The problems with these two types of slides are economic in that they require a large volume of water to be continually washed down the slide, namely around 300-500 gallons (1,365 to 2,275 litres) per minute with the first type and 600-950 gallons (2730 to 4320 litres) per minute with the second type. As the water must typically be pumped up to a level 30 to 40 feet (9 to 12 metres) above the pool of water the expense involved in the pumping of such a large volume of water makes the operation of the water slide generally prohibitive unless a large number of people are utilizing the slide.

Accordingly, it will be seen that there are a variety of problems to be solved in the provision of water slides, for example, how to reduce the wear on both the slide and the sleds, how to make a sled ride more smoothly, how to make the ride more exciting and faster, and how to make a sled coast further across the water while making the rides safer.

An object of the present invention is at least to mitigate the problems of known water slides.

Accordingly, the invention provides, a slide structure for use with a sled, which slide structure comprises a support framework having a lower section, for positioning adjacent a pool of water, and an upper section

adapted to be disposed at an acute angle from the horizontal, said support framework having two sidewalls and a base adapted to support a sled in a downwardly sliding path; a plastics sheet material being provided on said support structure base to present an upper surface adapted to be slidably engaged by a sled, a manifold connected at the undersurface of said plastics sheet material closely adjacent a top end of the said slide support framework; means for supplying water under pressure to said manifold; and a plurality of holes through said plastics sheet material at said manifold to provide a water exit from said manifold to the upper surface of said plastic sheet material so that water will form a film on at least that part of the upper surface slidably engageable by a sled.

It is a feature of an embodiment of the invention to provide a slide structure with a wetted plastics film surface so that a sliding movement between a plastics-surfaced sled and the plastics-surfaced slide structure is facilitated.

Another feature of embodiments of the invention is to provide a plastics-surfaced slide structure at the sled-to-slide engaging surfaces for a fast, smooth amusement ride.

In order that the invention may be more readily understood, and so that further features thereof may be appreciated, an embodiment of a slide of the invention will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is a side elevational view of a slide constructed in accordance with the invention;

FIGURE 2 is a plan view of the slide of Figure 1;

FIGURE 3 is an enlarged, perspective view of a part of the slide of Figure 1;

FIGURE 4 is an enlarged perspective view of part of the underside of an upper section of the slide of Figure 1;

FIGURE 5 is an enlarged view taken on the line 5-5 of Figure 1;

FIGURE 6 is an enlarged, cross-sectional view of the slide of Figure 1;

FIGURE 7 is an enlarged, longitudinal sectional view taken on the line 7-7 of Figure 2 to show the base of the slide;

FIGURE 8 is an enlarged, cross-sectional view showing on the left and right hand sides, respectively, two different portions of the plastics slabs on the slide of Figure 1;

FIGURE 9 is an enlarged, partial view taken on the line 9-9 of Figure 1;

FIGURE 10 is a cross-sectional view taken on the line 10-10 of Figure 9; and

FIGURE 11 is a side elevational view of Figure 9.

The drawings illustrate a slide structure 15 which is usable for sleds for human occupancy, one such sled 16 being illustrated schematically in Figure 1. The slide 15 may be designed to enable the sled to slide down a predetermined pathway onto a generally horizontal surface, such as the upper surface of a body of water 17. The slide structure 15 comprises a support framework 18 which includes four longitudinal rails 19, 20, 21 and 22. The four rails are generally parallel, with the rails 19 and 20 providing a base and the upper rails 21 and 22 providing upper edges to sidewalls 23 and 24. These longitudinal rails may be of rectangular cross-section steel tubing and are joined to U-shaped structural angle members 25 by a suitable means, such as welding. These U-shaped structural angle members may be placed at intervals along the length of the support framework 18, e.g. at five-foot (1.5mm) intervals, and are formed from elements of L-shaped cross-section. Inverted U-sectioned channel members 26 extend between the lower longitudinal rails 19 and 20 and are secured thereto by suitable means, such as welding. These channel members 26 are also spaced at intervals along the length of the support framework, for example, at a spacing of 12-18 inches

(300 to 450mm). Structural angle members 27 and 28 extend longitudinally along each side of the support framework, between successive U-shaped structural angle members 25, and are secured thereto by suitable means, such as welding. The structural angle and channel members may be made of steel, and the sidewalls 23 and 24 may be made of a sheet material, for example of 0.08 inch (2mm) aluminium sheets secured to the structural angle members 25, 27, and 28. The succession of inverted U-sectioned channels 26 and the top of the lower longitudinal rails 19 and 20 define a base 30 of the support framework 18.

As better illustrated in Figure 1, the slide structure 15 has a straight but inclined upper section 31 and a lower section 32. The upper section is supported at an acute angle to the horizontal for example at an angle of about 45°. The lower section 32 has a curved or radius portion 33 and a substantially horizontal portion 34 terminating at a lower end 35 of the slide 15. In use the lower end 35 is desirably spaced a slight distance above the nominal surface of a body of water 17. The horizontal portion 34 of the slide structure 15 may be supported on any suitable foundation on the ground. A support column 36 is provided to support the slide structure generally at the junction of the upper and lower sections 31 and 32, and an upper end 37 of the slide structure may be supported on a support tower 38, the details of which are not illustrated.

The upper section 31 may be constructed as one unit at the factory, and the lower section 32 may be constructed as a separate unit, the two units being assembled at a desired location for use. At the adjoining ends of the two sections 31, 32 each section may have a U-shaped structural angle member 25, as shown in Figure 6, which includes holes 40 for receiving bolts which may be secured by suitable nuts to hold the upper and lower sections 31 and 32 together during erection and completion at a pool site. A suitable sled-starting gate 41 may be provided at the slide upper end 37.

The slide structure 15 also includes a plastics sheet material 42 which is mounted on the support structure base 30 defined by the lower rails 19 and 20 and channel members 26. This plastics sheet material presents an upper surface 43 as a sled-engageable surface. In one preferred embodiment, the plastics sheet material 42 is in the form of a number of relatively

rigid slabs 44 of a plastics material, for example of an ultra high molecular weight (UHMW) polyethylene, which may be 3/8 inch (10 mm) thick and which covers the entire width of the base of the slide structure 15 (which may, for example, be about 29 inches (740 mm)). This is better shown in Figure 10. Upstanding path guide portions 46 secured to the sidewalls 23, 24 are located adjacent two opposing sides of said plastics sheet material 42 to extend longitudinally relative to the slide structure base. The path guide portions are engageable by the sides of a sled should it deviate from a median pathway during its decent of the slide.

As shown best in Figure 10, which is a partial sectional view through the upper slide section 31, the path guide portions 46, at lesat in the upper section 31 are formed integrally with the plastics slabs 44 which present the upper sled engaging, surface 43. To accomplish this, a longitudinal slot 47 is so milled in the top surface near each edge of the slabs 44 that the sides may be bent upwardly at these slots, which form integral hinge portions 48, permitting such bending. This feature is also shown in Figures 3, 6 and the right half of Figure 8. Since the plastics slabs 44 are relatively rigid, they span the distance between the longitudinal rails 19 and 20 and between the successive channels 26, and provide a good floor or support for the sleds 16.

In the curved portion 33 of the lower slide section 32, the construction of the path guide portions differs from that described above. This constructional difference is illustrated in the left half of Figure 8, wherein the plastics slabs 44A are shown to extend completely across the base of the slide, but are not formed integrally with the path guide portions 46A. The path guide portions 46A are separately formed from curved pieces, such as better shown in Figure 7, in order to fit the contour of the curve along the sidewalls 23 and 24. The base slabs 44A are also curved in a single plane to match the curve of the longitudinal rails 19 and 20. A watertight sealant, such as a silicone sealant 49, is used to join the plastics slabs 44A and path guide portions 46A.

Figure 8 also shows in detail one method of securing the plastics slabs 44 to the base 30 of the slide 15. As shown, plastics-capped heads 52 on bolts 53 are recessed into the plastic slabs 44 to secure the slabs in place. The countersunk holes into which the bolt heads are recessed are formed to be

slightly larger than the bolt heads 52 to permit expansion movement of the plastic slabs, since the coefficient of expansion of the UHMW polyethylene is about six times that of steel. Also, the hinge portions 48 permit this expansion and contraction with temperature changes.

The plastics slabs 44 and 44A may be of any practical length e.g. five feet (1.5m), and adjacent plastics slabs are joined, for example, by a ship-lap joint 54, to provide a watertight joint.

Means is provided to supply a film of water on the upper surface 43, of the slabs 44 which serves to greatly reduce the friction between the slide 15 and a sled 16 when the slide is in use. This water film supply means includes a manifold 56, which is connected at the undersurface of an uppermost one of the plastics slabs 44 closely adjacent the top end of the slide support framework 18. The manifold 56 is adapted to fit between the lower longitudinal rails 19 and 20. A gasket 57 and a number of plastics-capped bolts 53 are used to secure the manifold 56 to this undersurface in a watertight manner. A suitable pump 58, driven by an electric motor 59 is provided to supply water to the manifold 56. The pump 58 and motor 59 may conveniently be mounted on a bracket 60 suspended below the slide support framework 18 in a suitable location on the lower section 32. The pump 58 has a water inlet conduit 61 leading to the water pool 17, (or to any other convenient water source if desired) and has an outlet conduit 62 leading to the manifold 56 to supply water under pressure to this manifold. The manifold might, for example, be 30 or 35 feet (9 to 10.5m) in elevation above the pool. A plurality of holes 63 are provided through the plastics sheet material of the slab 44 on the region of the manifold to provide an exit for water from the manifold to the upper surface 43. The holes are disposed in at least one transverse row, and as shown in Figure 9, three such rows are provided in one preferred embodiment. The central holes in the plastics slab are formed to be substantially perpendicular to the plane of the slab, but the end holes 64 in each row are directed outwardly at about a 45° angle relative to the plane of the slab to cause water to spurt laterally towards the adjacent sidewall 23 or 24. This arrangement causes the water to be spread outwardly so that it forms a film over the entire upper surface 43 of the slabs 44.

The ship-lap joints 54, the sealant 49, and the unitary hinge portions 48 provide a watertight upper surface 43 so that the film of water spread across the width of the slide at the top remains a film of water on the entire slide surface throughout its length.

One form of a sled 16 that is suitable for use with the slide 15 is shown in Figure 10. The sled 16 may be made from a moulded cross-linked polyethylene to present a pair of outer runners 67, each being about five inches (130 mm) wide, and a central runner 68 that is about three inches (75 mm) wide. Thus, a total of about 13 inches (335 mm) of runner width may engage the upper surface 43 and the water film supplied by the manifold 56 and pump 58 is designed to provide a water film that is about 1/32" to 1/4" (0.8 to 6.5mm) deep on at least this slide-to-sled engaging surface. Since the slide-to-sled engaging portion of the surface 43 is only about 13 inches (335mm) out of the total width of about 29 inches (740 mm) of the slide base, the water need be supplied at a rate in the range of about one-half to one gallon (2.3 to 4.5 litres) per minute per one inch (26 mm) of slide-to-sled engageable surface.

Prior art water slides, for example those made of concrete and requiring a mat for protection of a person using the slide, have been found to require a much larger volume of water, in the order of 300-500 gallons (1365 to 2275 litres) per minute. Known water slides of the type not requiring use of a protective mat or sled, and which are generally made of a fiberglass-reinforced resin plastics material, have been found to require even more water, in the order of 600-950 gallons (2730 to 4320 litres) per minute. This is a large volume of water particularly considering the head of 30-40 feet (9 to 12 metres) against which the water volume must be pumped, and required pump motors in the order of 30 to 60 horsepower (22.5 to 45 kW). The present pump 58 requires only a one-third horsepower (230 W) electric motor for a 35-foot head, supplying 6 to 10 gallons (27 to 45.5 litres) per minute. Hence, it will be appreciated that this is a very great reduction in water flow, electrical power, and water filtration requirements for the water slide of the present invention.

The use of the water film on the UHMW polyethylene provides for a very low coefficient of friction of about 5-10% that of polished steel. Also

the resistance to weight loss by abrasion is about five times better than tetrafluoroethylene and about seven times better than that of high carbon steel. This combination of properties provides a preferred water slide of the invention with greatly improved results compared to the old slide with rollers in the base on which the sled supposedly rolled. It was found that in the prior art slide constructions utilizing rollers, when the sled got to the lower curved section, it was travelling at a fast speed, and as the sled hit each individual roller it could not accelerate that roller to the speed of the sled instantaneously. Thus, there was sliding friction between the sled and the roller rather than merely rolling friction. Many different types of bearings were tried in the rollers, including steel ball bearings, steel roller bearings, plain bearings, nylon bearings, and oil-impregnated wooden plain bearings. The latter seemed to provide the best combination of results, yet the slide was noisy, having a noise rating of about 96 db at a distance of 100 feet (30 metres). The present slide has been tested in operation and has only 56 db noise rating at the same 100-feet (30 metres) distance. This is a remarkable improvement, and permits installation and operation of the slide structure in quiet locations where loud noise would be objectionable. By eliminating the use of rollers, and by use of a plastics material, the sled has a smoother ride, the amount of wear is reduced on both slide and sleds, and lower friction permits a sled to accelerate to faster speed, allowing the sled to coast a longer distance on the water surface of the pool 17, so that the ride both down the slide and across the pool is more exciting. Also the invention provides an amusement ride which is likely to be safer because there is no space between any rollers into which a person might conceivably get his or her hand or foot caught.

In the prior art construction, some of the 0.06 inch (2 mm) thick aluminium rollers actually wore completely through and broke, and this was noted to occur primarily at the lower curved section, where the speed of the sled was about the greatest and where the G force was the greatest.

In prior art slides, the large electrical pumping power required made water slides uneconomical to operate unless there was a large number of people continuously using the slide. This was satisfactory on a hot summer Sunday afternoon, but the present invention permits economical operation of the slide all day long and all week long when an amusement park is open to the public.

The features disclosed in the foregoing description, in the following claims and/or in the accompanying drawings may, both separately and in any combination thereof, be material for realising the invention in diverse forms thereof.

CLAIMS:

1. A slide structure for use with a sled, which slide structure comprises a support framework having a lower section, for positioning adjacent a pool of water, and an upper section adapted to be disposed at an acute angle from the horizontal, said support framework having two sidewalls and a base adapted to support a sled in a downwardly sliding path; a plastics sheet material being provided on said support structure base to present an upper surface adapted to be slidably engaged by a sled, a manifold connected at the undersurface of said plastics sheet material closely adjacent a top end of the said slide support framework; means for supplying water under pressure to said manifold; and a plurality of holes through said plastics sheet material at said manifold to provide a water exit from said manifold to the upper surface of said plastics sheet material so that water will form a film on at least that part of the upper surface slidably engageable by a sled.

2. A slide structure according to claim 1, further comprising path guide portions of said plastics sheet material extending longitudinally relative to said slide structure base to be engageable by a sled should the sled deviate from a median path down the slide.

3. A slide structure according to claim 1 or 2, wherein said plastics sheet material comprises at least one slab of a relatively rigid plastics material covering said support framework base.

4. A slide structure according to claim 2 and 3, wherein said path guide portions are defined by a plurality of relatively rigid side slabs of plastics material extending a short distance up the sidewalls of said slide structure.

5. A slide structure according to any one of claims 1 to 4, wherein said plurality of holes through said plastics sheet material are disposed at various angles relative to each other to direct water to the entire width of the upper surface of the plastics sheet material.

6. A slide structure according to claim 5, wherein said plastic sheet material includes a plastics slab, said plurality of holes are formed in said plastics slab to cooperate with the manifold, and the holes are disposed in a

row transverse to said slide structure with the holes at one end of the row directed at about 45° angle to the slab in one lateral direction and the holes at the other end of the row directed at about a 45° angle in the other lateral direction relative to the plastic slab to direct water to the entire width of said upper surface.

7. A slide structure according to any one of claims 1 to 6, in a position for use, the upper section of the support framework being in a plane at about a 45° angle to the horizontal and the lower section thereof having a curved portion terminating in a substantially horizontal portion slightly above the nominal water surface level in a pool.

8. A slide structure according to any one of claims 3 to 7, wherein said plastic sheet material comprises a plurality of slabs and wherein each slab is connected with the next adjacent slab by a ship-lap joint.

9. A slide structure according to any one of claims 3 to 8, wherein slabs forming the plastics sheet material in said upper section each have a base portion and unitary upwardly extending sidewall portions joined by reduced thickness hinge portions at the junction of said base and sidewall portions.

10. A slide structure according to any one of claims 3 to 9, wherein the slabs forming the plastics sheet material in a curved portion of the lower section of the slide comprise separate but cooperating base and sidewall portions curved to fit the contour of the support framework; there being suitable sealant between said separate base and sidewall portions.

11. A slide structure according to any one of claims 1 to 10, wherein said plastics sheet material comprises an ultra high molecular weight polyethylene.

12. A slide structure according to claim 11, wherein said ultra high molecular weight polyethylene has a coefficient of friction of about 0.05 to 0.10, as lubricated with a water film, relative to polished steel.

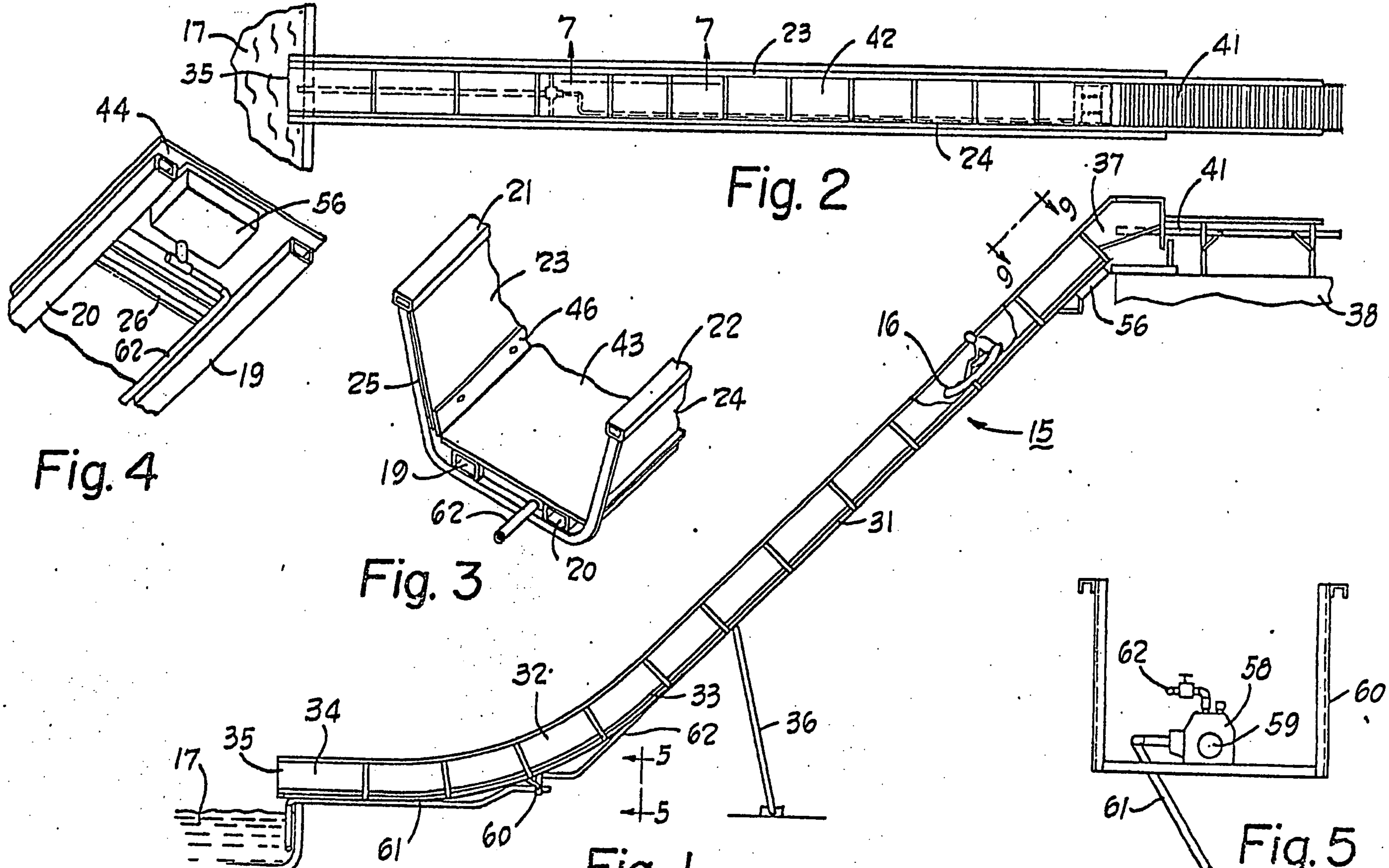

Fig. 2

Fig. 4

Fig. 3

Fig. 1

Fig. 5

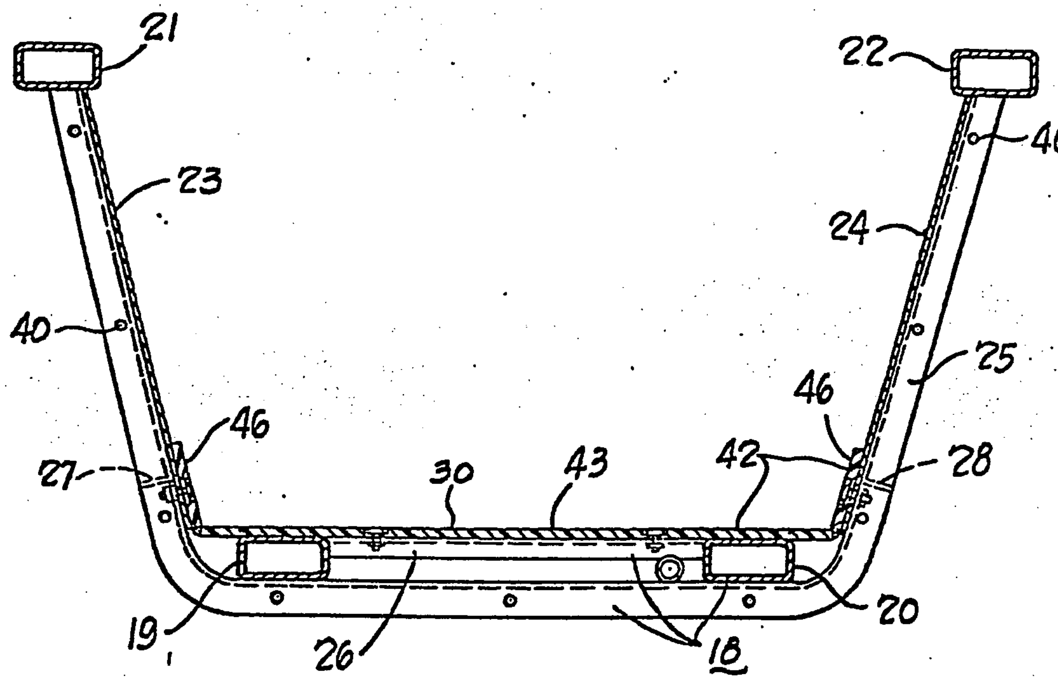

Fig. 6

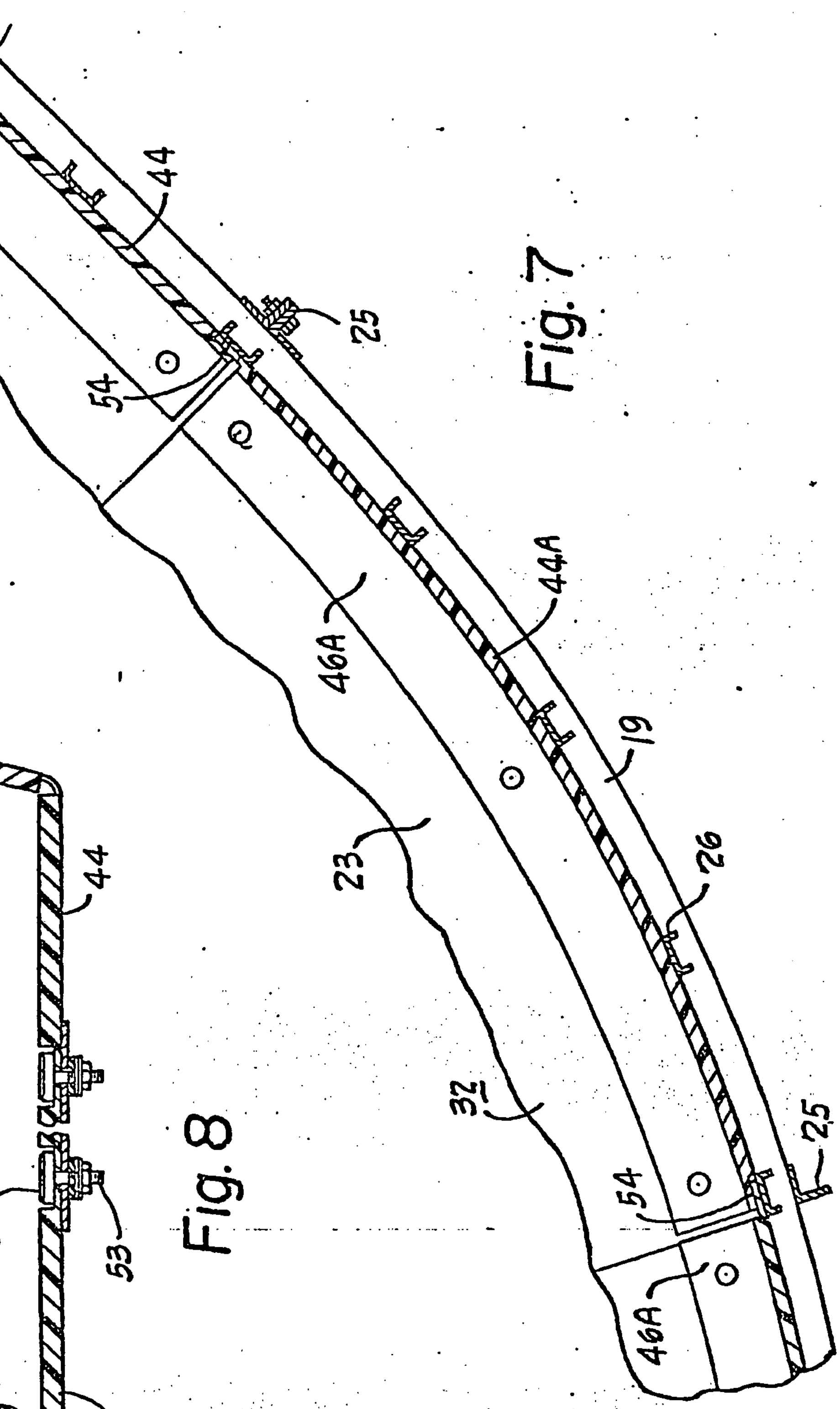
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Fig. 7

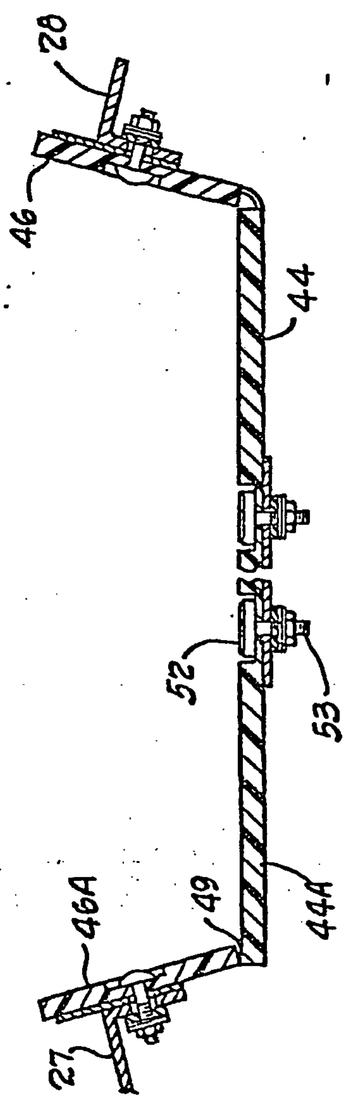
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Fig.8

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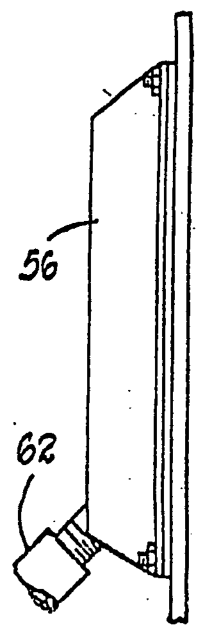

Fig. 11

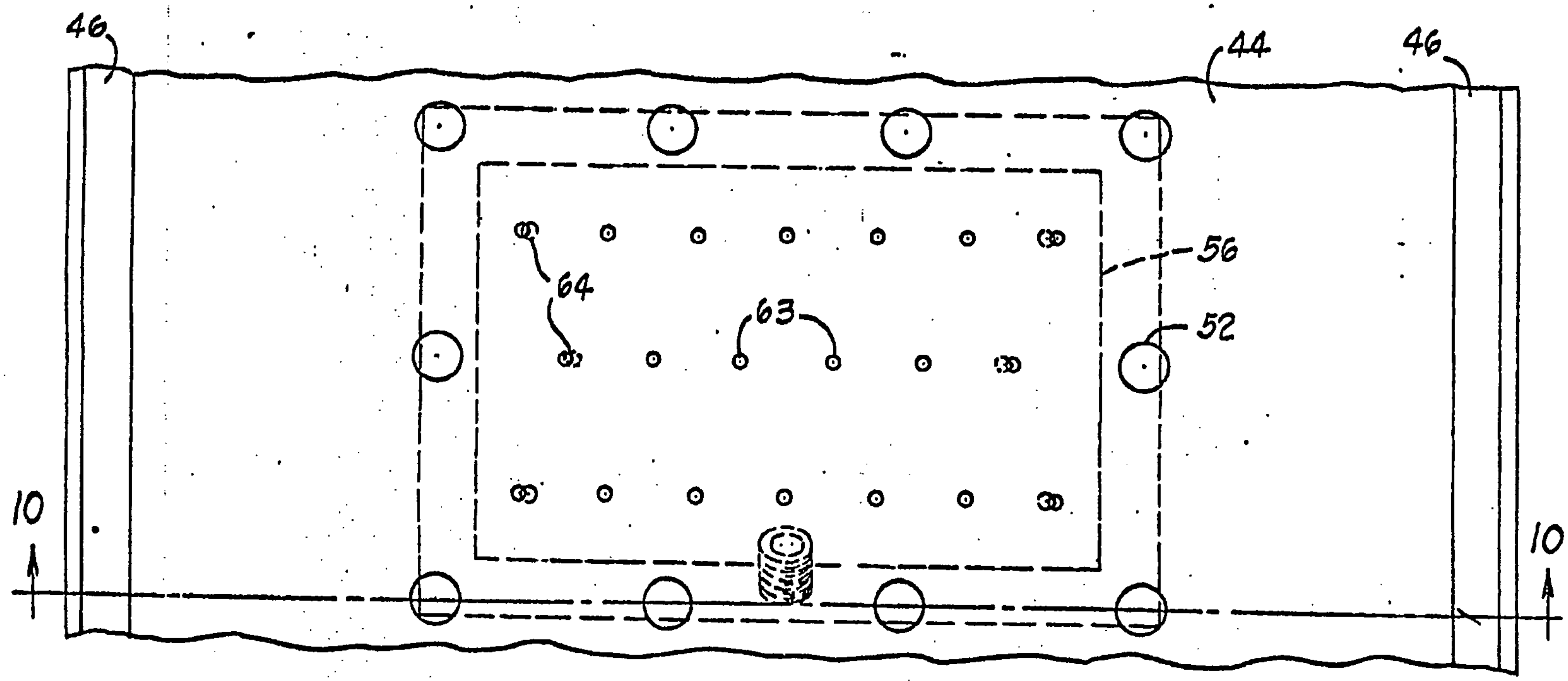

Fig. 9

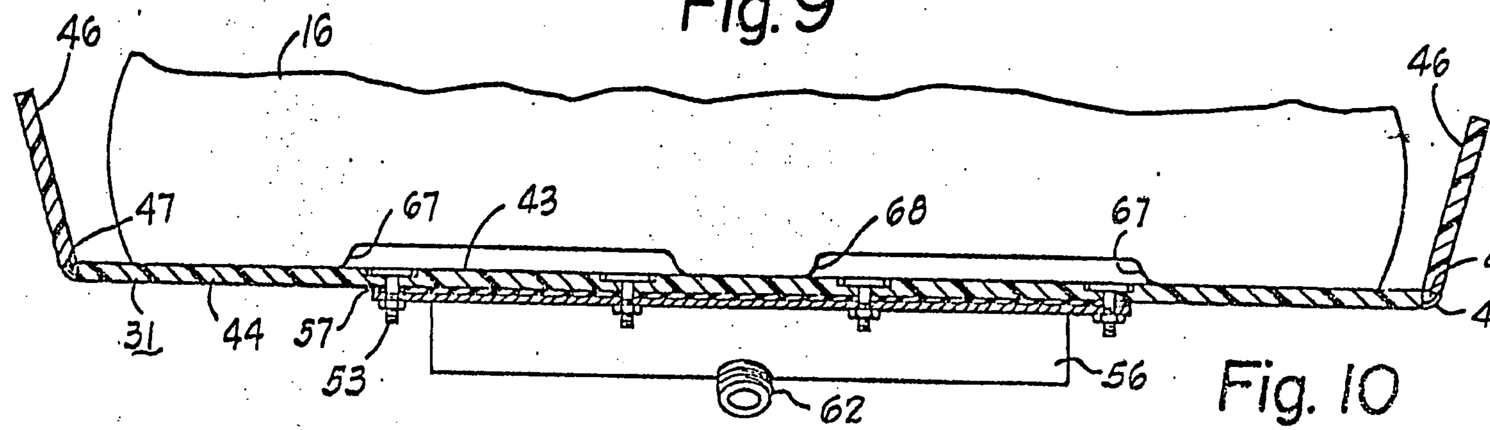

Fig. 10